

# AVAILABILITY OF SCIENCE LABORATORY IN SCHOOLS AT THE SECONDARY LEVEL

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The study determined the availability of science laboratories for teaching learning of science at the secondary level in selected secondary schools of Rajasthan. The research design adopted for the study was stratified random sampling— out of 33 districts of Rajasthan— three districts, namely, Jaipur, Nagaur and Ajmer were randomly selected. Then seven government secondary schools from each district were selected. Three instruments, which were prepared by a team of faculty members and RMSA cell members were used for the collection of data for the study. They are questionnaires for principal/headmaster of the school, teachers and students focus group discussion. The data were collected by visiting the concerned school personally by faculty members. The study showed that laboratory facilities are highly inadequate, far below the expectation and in most of the schools experiments are not conducted. It is, therefore, recommended that government should include practicals in science as a part of assessment and take immediate steps to set up science laboratories across the state for effective teaching and learning of science. It is also suggested to make the science teachers more resourceful in providing alternative material for science teaching and learning so that learners learn by doing and develop thinking skills and attempt at innovations.

**Key words:** *Science lab study, secondary stage, science kits, science practical*

## Introduction

Education is one of the basic needs of human beings. Science education needs to build on the knowledge and skills acquired by the learners so that students can understand the scientific principles, laws and theories. Progress of science can be checked by understanding the crucial role of experiments. Path breaking discoveries and inventions are possible only through investigations done usually in laboratories. Teaching and learning can be effected if teaching and learning centre is having adequate laboratory facilities. The laboratory has a direct effect on both students' attitudes and academic performance. Based on the instructional theory of learning interaction, It is generally believed that constant practice

leads to proficiency in what the learner learns during classroom instruction; hence, the dictum 'practice makes perfect' (Hager, 1974). Adequate laboratory facilities should be provided to secondary schools for effective teaching and learning. The laboratory has been a distinctive feature in science teaching and learning (Hoftein and Ginetta, 1992). A study on the objective of laboratory work in chemical education argued that laboratory work can contribute to improving conceptual understanding, practical skills and inter-variable relationship among learners (Garnett and Hackling, 1995). The adequacy of laboratory facilities used during science instruction helps to develop values that aid the learners in decision making (Lagoke, 1997). The adequacy of laboratory facilities makes chemistry teaching more concrete and stimulating and hence for better students'

academic performance in secondary schools. Academic performance depicts the level of educational attainment of an individual. It differentiates one with high knowledge content from the other with low and less competency in academic performance (Eshiet 1996). The role of practical work in science education is ill-defined. The author suggests that one of the familiar aims of practical work, teaching for the development of 'experimental skills', is best regarded as having a distinct knowledge base linked to the understanding of scientific evidence. The significance and value of an understanding of evidence for employment in science, engineering and in regard to scientific literacy in the community is discussed (Gott and Duggan, 1996). The adequacy of laboratory facilities had a significant effect on the students' academic performance in chemistry (Okafor, 2000). The influence of adequacy of laboratory facilities and academic performance in chemistry had found that adequacy had significant influence on students' academic performance in secondary school chemistry teaching (Aburime, 2004). He, while investigating the relationship between adequacy and academic performance in Chemistry, had examined adequacy of laboratory facilities in terms of using frequency counts and percentages. For students to learn efficiently, teachers should ensure that adequate laboratory facilities are procured. The extent of adequacy of laboratory facilities for science teaching depends on the population of students in a particular school. A few studies have been reviewed to understand the status of laboratory uses and its implications. In the present era of education, a good quality science education is needed because constantly new information is added to the existing information. In a welfare state like India, it is the responsibility

of the government to provide education to all. In support of this and the Convention of the Rights of the Child (CRC, 1989), India has promulgated the Right of the Child for Free and Compulsory Education Act and provides free education to children up to the age of 14 years or till the completion of elementary education (RTE Act 2009). However, there is a public demand to extend free education up to the secondary level. At this level, children study several subjects as compulsory and one of them is science which comprises physics, chemistry and biology. While performing learning activities in the form of practical work in science, students observe, investigate and develop an understanding of the world around them, through direct, often hands-on experience of phenomena or manipulating real objects and materials. Laboratories play a significant role in transacting effective science education at secondary level (NCF, 2005). *The National Curriculum Framework (NCF)* has clearly stated the objectives of teaching science to bring change in the ways of thinking and action in young minds of the school going children. It also emphasises that the teaching of science should result in enabling children to examine and analyse everyday experiences. The objective of science teaching includes:

1. To understand the cumulative nature of science and scientific knowledge.
2. To find inter-relationship and interdependence of different branches of science.
3. To recognise and enjoy some scientific aspects of their natural and manmade environment.
4. To acquire skills.

Beside the above objectives at the secondary level, students should be equipped with the skills of accessing information in the science laboratory with some general features like:

1. The science laboratory attempts to vary the learning environment in which students develop their understanding of scientific concepts, science inquiry skills, and perceptions of science.
2. The science laboratory, a unique learning environment is a setting in which students can work cooperatively in small groups to investigate scientific phenomenon.
3. The social environment in a school laboratory is usually less formal than in conventional classrooms; thus, the laboratory offers opportunities for being productive. Cooperative interactions among students and with the teacher have the potential to promote a positive learning environment.

## **Need of the Study**

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In the context of Universalisation of Secondary Education (USE), large-scale inputs in terms of additional classrooms, teachers and laboratory facilities need to be provided to meet the challenge of numbers, credibility and quality. *NCF (2005)* stated that schools, particularly those in rural areas, are poorly equipped with science labs, or equipment for mathematical activities. The absence of such facilities drastically narrows subject options for children, denying them equal opportunities for learning and future life chances. It is, hence, important that resources are made available for laboratories with adequate

facilities in schools. While elementary schools can benefit from a science and mathematics corner, secondary and higher secondary schools require well-equipped laboratories. In the RMSA framework importance has been given to schools to setup laboratories as a part of strengthening infrastructure and utilise them. There is need to identify the need of laboratories and their utilisation in government secondary schools. The present work has been taken in view to identify the laboratory facility in the selected government schools and their utilisation with the objective to identify the availability of lab facilities for teaching of science.

## **Methods and Procedure**

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The sample of the study was based on stratified random sampling. At the first stage, out of the 33 districts of Rajasthan, three districts namely Jaipur, Ajmer and Nagaur were randomly selected in consultation with the RMSA of Rajasthan. At the second stage, from each of the districts seven government secondary schools were selected. As complete information could not be collected from two schools each in Nagaur and Jaipur, later two more schools were selected from these districts which were not in the original list. Therefore, the total number of schools was 23, the total number of teachers was 24 as there were two teachers each in three schools. With regard to principals, from 21 selected schools, the person who was heading the school on the day of the visit of the Investigator was considered as principals in the study. Therefore, the number of principals was 21. With regard to students, Structured Focus Group Discussion (FGD) was held in all the schools separately for

Classes IX and X. For classes IX and X, 19 and 18 FGDs were held respectively. In each group there were 10-15 students representing the class.

*Tools used in the study:* Three tools for principals, teachers and for students in the form of questionnaires were developed at NCERT by the RMSA Project Group involving the selected faculty from all the Regional Institutes of Education. Description of each tool is given in the following paragraphs.

*Data collection:* Faculty from the Department of Education in Science and Humanities from Regional Institute of Education, Ajmer were allotted schools for visiting and collecting the data. As per the schedule, the faculty visited the schools, observed the laboratory facilities, and administered the tools to the principal, teachers teaching science at the secondary level and the students of Classes IX and X. While each principal of the school and teachers teaching science for Classes IX and X were given the questionnaires to be filled by them, the students were administered the interview schedule. With regard to the students, FGD was held for the representatives of students from Classes IX and X separately in each of the schools.

The responses given were tabulated for the purpose of analysis.

## Results and Discussion

The responses regarding the availability of Laboratory facilities in schools are presented in Table 1.

Laboratory is expected to be present in every secondary school for the conduct of experiments in science. It is surprising to note that out of the 23 schools selected for the study, only one school has a working science lab. As per the responses given by the teachers, only eight teachers (33.33 per cent) have said that they have an integrated lab for science whereas the rest 66.67 per cent of the teachers have said that they do not have a lab for science. With regard to principals of the schools, 60.86 per cent said that they do not have labs in the schools and further, students in 22 FGDs also said that they do not have labs in the schools. While students in 9 FGDs said that they use lab once a week, students in three FGDs said that they use lab twice a week.

The responses regarding the accessibility of Curricular materials are presented in Table 2.

**Table 1**  
**Availability of Laboratory Facilities**

Responses					
Principal		Teachers		Students' Focus Group	
Yes (%)	No (%)	Yes (%)	No (%)	Yes (%)	No (%)
9 (39.14)	14 (60.86)	8 (33.33)	16 (66.67)	15 (40.54)	22 (59.46)

**Table 2**  
**Accessibility of Curricular Materials**

Accessibility of Curricular Materials	Teacher Responses	
	Yes (%)	No (%)
NCF-05	6 (25)	18 (75)
RSCF	5 (20.83)	20 (83.33)
Syllabus	20 (75)	6 (25)
Textbook	13 (54.17)	11 (54.83)
Supplementary Materials	12 (50)	12 (50)
Lab Manual	6 (25)	18 (75)

Learning and teaching is always strengthened by referring to curricular materials. When teachers were asked whether they have access to *NCF-2005*, 25 per cent of the teachers have said that they do have, but 75 per cent of the teachers said that they do not have access to *NCF-2005*. It is well known that Rajasthan has not developed its own Rajasthan State Curriculum Framework (RSCF), but follow textbooks of NCERT at the secondary level. In spite of that, when asked whether, the teachers have access to RSCF, 20.83 per cent of the teachers have said 'Yes'. This shows the awareness of teachers with regard to RSCF. Curriculum is always followed by syllabus, when teachers were asked whether they have access to syllabus of science, though 75 per cent have said 'Yes' 25 per cent have said 'No', which means there are teachers or schools which do not have a copy of the syllabus or they are not made available to teachers.

In our country textbook is the whole and sole in most of the schools, even then, teachers were asked to respond whether they have

access to any supplementary materials in science. While 54.17 per cent have said 'Yes', 45.83 per cent have said 'No'. This indicates that only around 50 per cent of the teachers have access to supplementary materials in science. With regard to accessibility of lab manual, it is very poor. Only 25 per cent of the teachers have said that it is accessible to them and the students of 34 FGDs informed that they do not have any manual or guide. But as per *NCF-2005*, manuals and resources for teachers are as important as textbooks and there is also a need for teachers' handbooks. These would provide tips for teachers, which they could use for lesson planning. But the reality is different. Teachers usually are accustomed to do anything whenever there is some official instruction. When the teachers were asked, whether the curriculum document of the state and the textbooks provide experimentation in science lab, about 65 per cent of the teachers said that they are expected to conduct experiments in the lab whereas the rest (35 %) said that the curriculum does not recommend and there is no scope in the textbook for conducting

experiments. Some examples which indicate the scope in the textbook for conducting the experiments are listed below. Chemical reaction, oxidation and reduction, pH paper experiments.

## Major Findings of the Study

- Integrated lab for science is available only in  $\frac{1}{3}$  of the schools.
- One fourth of the teachers have access to *NCF-2005* and lab manual whereas  $\frac{3}{4}$  of the teachers have access to science syllabus and  $\frac{1}{2}$  of the teachers have access to supplementary materials to teach science.
- Many teachers have said that they are expected to conduct experiments in the lab as per the curriculum and the guidelines given in the textbook.
- There is availability of recurring grant for procuring the chemicals as per the words of about 16 per cent of the teachers but as per the words of 95 per cent of the teachers there is no grant for replacing the equipments that are broken/ malfunctioning, etc.
- Student-computer ratio is very high in most of the schools.

- Many labs are not equipped enough to conduct activities and in most of the schools experiments are not conducted.
- For making learning science effective, teachers use science kit, models and CDs/AV materials.
- For breakage of lab materials students are neither fined nor punished.

## Conclusion

The study was specially meant to find out the extent of adequacy of laboratory facilities for conducting practicals and students' academic performance. The study attempted at finding the adequacy of science laboratory facilities for effective teaching and learning of science in government secondary schools of Rajasthan. Findings of this study showed that laboratory facilities are highly inadequate. It is, therefore, recommended that government should take immediate steps to set up science laboratories across the state for effective teaching and learning of science. It is also suggested to make science teachers more resourceful in providing alternative materials for science teaching and learning so that learners learn by doing and develop thinking skills and attempt at innovations.

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